***Neisseria meningitidis* (meningococcal meningitis)**

**Signs and symptoms for the disease it produces.**

* Pt was a **20 yo** male, college student
* Brought to ED in **early January**
  + peak incidence in late winter and early spring
* **Fever**
* **Chills**
* **Severe headache**
* Confusion/agitation
* **Purpuric skin lesions**
* **Hypotension**
* **Neck stiffness**

**The source of infectious organism.**

* *Neisseria meningitidis*

**The manner of exposure, route of infection, tissues that they reside and, where appropriate, transmission to others.**

* **Human carriers**
* **Person-to-person spread via respiratory droplets**
* **Leading cause of bacterial meningitis** in **children** and **young adults** in the US
* Large-scale epidemics (due to serogroups A and C) in the meningitis belts of sub-Saharan Africa affect mostly adults

**The pathology and the manner by which the particular disease develops and/or is induced, including damage caused by the pathogen and damage caused by the immune system’s response to the pathogen.**

* Incubation from 2-10 days
* Sequential steps of pathogenesis
  1. Nasopharyngeal colonization
  2. Bacterial invasion of and survival within blood stream
  3. Penetration of BBB and egress into CSF
  4. Local release of inflammatory cytokines in CSF
  5. Adhesion of leukocytes to brain endothelium and diapedesis into CSF
  6. Exudation of albumin through opened intercellular junctions of meningeal venules
  7. Brain edema, increased intracranial pressure, altered cerebral blood flow
* Meningococci attach selectively to microvilli of nonciliated columnar epithelium in nasopharynx
  + Pili allow colonization and **IgA protease** enhances colonization
* **Polysaccharide capsule is antiphagocytic**, protecting from phagocytosis in blood stream
* CNS injury due to inflammatory response mediated by TNF and IL-1, triggered by LOS-associated endotoxin
* Cytokine mediators induce fever
* Intense pyogenic inflammation in CSF and meninges
* Brain edema w/ increased ICP causes severe headache and stiff neck
* Release of LOS-associated endotoxin into the blood stream leads to thrombocytopenia
  + Associated with disseminated intravascular coagulation and **purpuric rash**
* Rapid hypotension
* In some pts infection may be limited to **blood stream (not meninges) = meningococcemia**
  + These pts usually have extremely high levels of TNF and IL-1 due to the bacteria rapidly multiplying
  + **Petechiae and purpura** present in most cases
  + **Fulminant form of meningococcemia is a rapidly progressing lethal disease**
    - Death due to shock and cardiac failure

**Methods of identification and placement into a particular biological subset.**

* **Take CSF**
  + Gram stain and culture
* Blood cultures
* Direct antigen detection
* *N meningitidis* is **gram negative** and found as **diplococci** or in tetrads. Diplococci may show flattening of adjacent sides, giving a “coffee bean” shape. **Surface capsule** and outer membrane-bound **lipooligosacharide (LOS)-associated endotoxin** are **virulence factors**. Common capsular polysaccharide-specific serogroups of the encapsulated pathogen are A, B, C, Y, and W-135.
* Blood and CSF cultures require chocolate or blood agar and CO2. Isolates are **oxidase positive**. Acid is produced from **fermentation of glucose and maltose** but NOT lactose.

**Factors leading to enhanced resistance or susceptibility (e.g., recipients of vaccines, residence in geographic areas, types of work, immunodeficiency, alcoholism, age, violence/abuse, religious beliefs, etc.).**

* Children under 5 w/o protective antibodies (not being vaccinated)
* **Congenital deficiency of terminal complement components (C5-C9)**
* Close contact with infected individuals and individuals with **functional or anatomic asplenia**

**Other organisms in the differential diagnosis and how to discriminate among potential causative agents.**

* Bacterial meningitis
  + *Haemophilus influenza*
  + *Listeria monocytogenes*
  + *Streptococcus pneuomoniae*
* Rocky mountain spotted fever
* Sepsis

Age of patient is important in determining the most likely organism. In this case (20 yo pt), *S pneuomoniae* and *N meningitidis* are the most common causes, and the purpuric rash is highly characteristic of *N meningitidis*. RMSF presents a similar clinical picture, especially the rash.

**Prevention, treatment and vaccine design (live vs. dead).**

* **Penicillin G** is DOC for meningococcal infection. Could also use cefotaxime or ceftriaxone and chloramphenicol. Penicillin G can penetrate inflamed meninges.
* **Polyvalent vaccine against capsular polysaccharide groups A, C, Y, and W135** is available for children over 2. No vaccine against type B, because type B is a sialic acid polymer, which is an endogenous surface component of host RBC.
* Vaccination is useful for protection of travelers to hyperendemic areas and for individuals at increased risk.
* Prophylaxis for individuals exposed to patients with meningitis is recommended. Rifampin, oral ciprofloxacin, or IM ceftriaxone are all effective.